Some Phases of Darwinism.*

Mr. Wallace has long been known as an earnest advocate of those theories of modern science concerning the origin and development of the varied forms of living things, vegetable and animal, which found in Charles Darwin their most famous exponent. The theories of evolution had long before been propounded. It remained for Darwin to show ways in which the slow processes of change, in the progress of heredity from generation to generation, could operate, while following lines that occa-

* Darwinism. An Exposition of the Theory of Natural Selection, with some of its Applications. By Alfred Russell Wallace, LL.D., F.R.S. New York: Macmillan & Co.

sionally bifurcated and continually diverged to produce the infinite varieties of living things found together upon the earth. Darwin's work was that of a large-minded architect, whose fertile invention devised some grand edifice, symmetrical in outline, multitudinous in detail, harmonious in purpose and in adaptation thereto. Mr. Wallace is the thrifty conservator, who goes about with loads of fresh material to repair breaches, strengthen weak places, complete and embellish unfinished apartments, and maintain the whole in a fresh, cheerful, and attractive condition, ready for visitors. His book is pleasant reading for one who has a lively and abiding interest in Nature's processes and vagaries. In it is collected a multitude of observations, classified as to the phases of the general subject which they illuminate. They who have already accepted the leading principles of the Darwinian scheme of world-building and world-peopling will find abundant food for enjoyment and for the refreshing of their faith.

Without saying how many more might be found and considered, there are three respects in which all works of this class are singularly alike, if not as singularly open to criticism. The first is the method of selection, whether "natural" or other, by which facts are gathered and grouped. The maker of a mosaic gathers bits of stone from all quarries, of all hues and grades of brilliancy. One by one he selects and assembles these separated fragments, until the outcome is an artistic design, which, as such, is faultlessly beautiful and admirable. But when it is finished, is it not evident that the *chef-d'œuvre* is not the reproduction of nature, but a purely artistic creation, the fruit of a vigorous and active imagination? The student who is searching for "Facts for Darwin" often appears to be most interested in selecting those which will fit kindly into the mosaic; while he unconsciously neglects, or more positively rejects, other and possibly more abundant items for which the mosaic appears to have no place.

For example, we find Mr. Wallace repeating the account of the very remarkable series that has come down to us through successive geologic epochs, beginning with the Eohippus, and continuing through oro-, meso-, mio-, proto-, and plio-hippus, until it ends in the modern hippus—equus, or horse. Professor Huxley is quoted as saying that this case "is demonstrative evidence of evolution; the doctrine resting upon exactly as secure a foundation as did the Copernican theory of the motions of the heavenly bodies at the time of its promulgation." If Professor Huxley says this, and means "exactly" what he says, then this secure foundation is no foundation at all; for the Copernican theory of the motions of the heavenly bodies had no demonstration until in after days Kepler and Newton showed the reasons for those motions and their uniformity. The case of the series from Eohippus to horse is one in which it is evident that evolution *may* have occurred. We may go farther, and agree that there is strong probability that it did occur. But strong probability is not demonstration, at least in any other department of exact science. It is one of the notable things in this work, as it is in others of its class, that the statements and explanations constantly culminate in the word "may." The evidence that a certain thing *may* happen must be very strongly buttressed before it crystallizes into the certainty that it did occur. There is a large gap, often an impassable gulf, between the assertion "this may be" and the conclusion "therefore it is." Yet this transfer is so often made in discussions of this subject, so subtly, so naively—as if logic never dreamed of anything more drastic—as to make the second of the three singular things referred to.

The theory of Copernicus was in his day only a case of *may:* it might be true. Later, Kepler gave it enduring life by demonstrating for it the condition of *must:* it must be true; it cannot be otherwise. This is the condition demanded of the physical science of to-day. This is the form of answer given by Newton, La Place, Faraday, Bunsen, Kirchhoff, Pasteur—the astronomers, chemists, spectroscopists, and bacteriologists, whose methods and whose logic are worthy the name of demonstration.

A criterion of the truth of a physical law is the uniformity of its operation. The law of gravitation, as formulated by Newton, acts always, everywhere, and without variation. But even if we admit, in the case of the Eohippus-horse, that here was evolution, the theory of evolution is not proved until it is shown that this is a complete example of all animal progression. Of course this does not mean that all animals would be evolved after the same exact fashion; for example, that each one which had a surplus of hoofs, like the Eohippus, should lose them from time to time, so that whereas it once may have had four hoofs on each foot, it has kicked them off suc-

cessively in the back stables of creation until now only one hoof per foot remains. But we may expect, we have a right to demand, that such general demonstrations of progression shall be shown, not as the possible explanation of a single series of facts, but as the absolute and incontrovertible reason for the existence of those facts, and shall lead us directly back to the fundamental law of all scientific truth, that like causes do produce like effects.

The attempt is made to realize this requirement by presenting the laws of selection—natural, sexual, etc. Mr. Wallace in terms recognizes the weakness of the attempt to establish a tenable theory upon experiments with animals and plants under domestication, and he has sought a better foundation in the variations of organisms under natural conditions. But the difficulty seems to remain. Given all the time that is demanded for the slow and complex changes said to occur—practically infinite,—it seems hardly possible that the changes should not have been completed, and that while the fittest have survived, the less fit, the unfit, should have perished. If it be said that this is precisely what did happen in the Eohippus-horse series, why has it not happened with all the rest? Some one may ask a definition of the word "fitness." It may not be easy to give a definition, farther than to say that the fittest is best adapted to the most vigorous life or to the greatest immunity from danger.

Among the forms of improved fitness, producing greater immunity from danger, and therefore prolonging life, at least of the species, is that often referred to as mimicry. This use of the word seems peculiarly inappropriate. Mimickry is not simply imitation. It is imitation with an intention or design on the part of the mimic. Let us see how the mimic or the imitator becomes the fittest to survive. As writers on these subjects, our author included, constantly select their examples to suit their purposes, we may be permitted the same privilege. Two species of butterfly, of the same genus, inhabit the middle parts of the United States. The general hue of one is yellow-brown, and it is called Misippus; the other is bluish-black, and it is called Ursula. To the casual observer, man or bird, Misippus very much resembles another rather larger insect, called Archippus. An inattentive observer would readily confuse the two. Now it is asserted that Misippus has mimicked Archippus; that is, under the operation of the law of survival, the fact that it resembles Archippus has been a protection to it, growing through the ages more protective according as the resemblance has become more complete. It is presumed that Archippus has some quality which gives it protection against its enemies: perhaps it may be nauseous to the taste, so that birds will not eat it. It is presumed that Misippus, by wearing the livery of Archippus, has cheated the birds, and has therefore escaped alive oftener than it otherwise would have done, and that thus the species has been better perpetuated. But Ursula is still alive and plentiful. Is she also masquerading in borrowed livery? and if so, of whom did she borrow? It is not so easy to see whom Ursula has mimicked. If mimicry has saved Misippus, the sister must also have practiced the same deception, or by this time she should have perished from off the face of the earth, unless, perchance, she was herself nauseous to the taste. It must have taken a long time to have produced gradually so great a difference as exists in the garb of these sister species.

It is evidently absurd to suppose that the butterfly or its ancestors had any intelligent purpose of imitation. It could not have changed its own coloring if it had so desired. It cannot be supposed to know that it will have offspring, nor how they will be dressed, nor how their garments will endanger them, nor how to avert the danger by an imitation of something else. If the imitation came not by forethought, it must have come under the action of some law; or without law—as we say, by accident. If it came by law, why was not the law operative upon all the creatures of that kind? Why were not both changed, or why has not one perished? When the explanation is examined in detail, it is vastly more marvellous than the fact which it seeks to explain. And still the question lingers, whether Misippus is any better fitted to survive than is Ursula.

As with fitness, so with utility. A single example will illustrate the amusing straits to which one is put who attempts to explain the utilities of such items as peculiarities of color, according to our human ideas of utility. The example is the ordinary field rabbit, sometimes called cotton-tail. The general garb of the rabbit is such as to make it almost invisible when it is quietly seated on its form, but when it is disturbed and runs away its white upturned tail makes it absurdly conspicuous. Mr. Wallace suggests that the white tail serves

as a danger signal when the rabbit is alarmed, so that the younger and feebler, following the white pennon of their leader, may the more readily escape to a haven of safety. How melancholy the fate of rats and mice, and such small deer as have developed no snowy banners for their rear-guard!

The sober gravity with which these things are put makes them the more notable. We wonder if in time the naturalists will not smile at each other when they meet, as did the augurs in ancient Rome.

SELIM H. PEABODY.